 GB P 3817

(12) UK Patent Application (19) GB (11) 2 278 959 (13) A

(43) Date of A Publication 14.12.1994

(21) Application No 9311202.7

(22) Date of Filing 29.05.1993

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(51) INT CL[5]
H01F 7/16

(52) UK CL (Edition M)
H1P PBA P201 P212
U1S S1772 S2063

(56) Documents Cited
GB 1591471 A WO 81/01626 A1 US 4829947 A
US 3895331 A US 3728654 A US 3634735 A
US 3202886 A

(58) Field of Search
UK CL (Edition M) H1P PBA PMR
INT CL[5] H01F

(54) Bistable latching solenoid actuator

(57) The actuator comprises a pair of coils 4, magnets 3, pole-pieces 5, 6 and an armature 2. In order to shift the armature, the coil adjacent the pole piece to which the armature is attracted is momentarily energised thereby cancelling the field due to the magnet and allowing the armature to be displaced towards the other pole piece where it is latched in place by the magnet. The actuator may be used in switching devices or electro-mechanical locks.

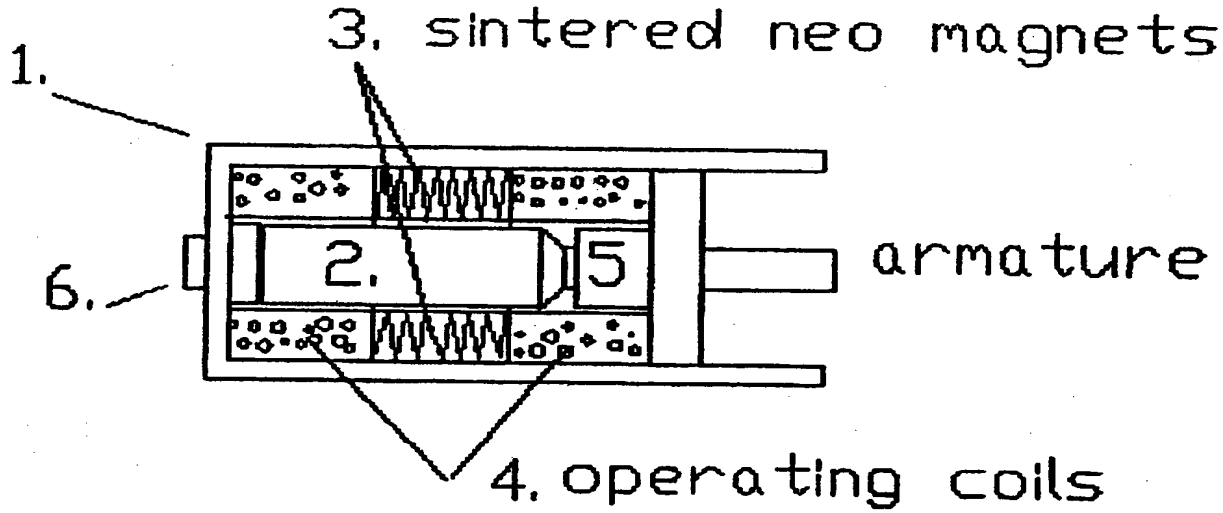

figure 1.

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The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

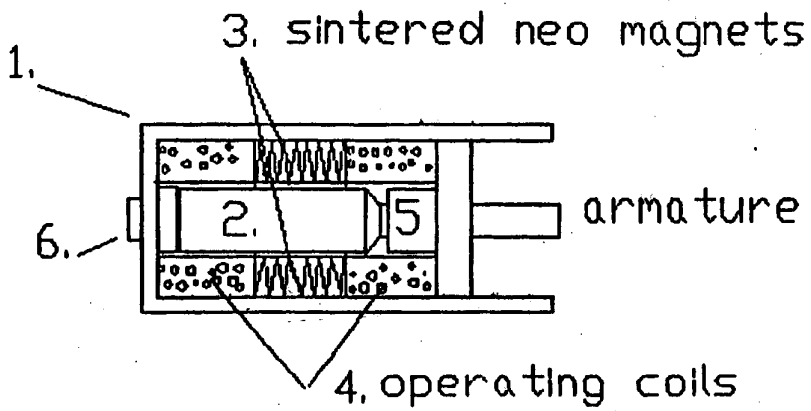

figure 1.

Bistable Latching solenoid

patent application drawing
Richard Harwood

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BISTABLE LATCHING SOLENOID

This invention relates to a solenoid, capable of positive latching, in either the in or out state, without the requirement for sustained electrical supply.

In its broadest aspect the solenoid provides the basis for a range of Electrical switching devices (heavy duty latching relays), and a range of Electro-mechanical Lock mechanisms(e.g. Domestic door locks electrically and/or remotely operated.)The utilisation of this invention would be in situations whereby it is undesirable or impracticable to maintain constant electromotive force to keep a solenoid in the in or out state, thus the device conserves energy and reduces risk of electrical originated fire

Claim Attributes:

The device obtains its moving force in either direction from permanent magnets.

The device remains stablely latched in either the in or out state.

The device requires only a pulse(typically 5 milliseconds) at its particular rated voltage to operate.

The device can provide balanced or unbalanced forces in its latched positions.

The device can be manufactured with a range of holding forces from fraction of kilogram force to in excess of hundred kilogram force.

DESCRIPTION:

The device utilise a closed magnetic loop, comprising of a moving armature (2.) and two pole pieces (5. & 6.) arranged as in figure 1. attached.

The static magnetic field utilised in the loop is provided by two sintered neo magnets. (3.) acting through the frame (1.) and pole pieces (5. &. 6).

The armature (2.) is attracted to its nearest pole piece where it remains in a stable condition. The attraction between armature and pole piece providing the latching force.

To change the state of the solenoid the coil surrounding the pole piece that the armature is currently attracted to is energised with a brief electrical pulse.This causes the temporary nullification of the magnetic field at the pole piece.

The remainder of the frame(1.) and the opposite pole piece remain saturated with magnetism, this cause the armature (2.) to become attracted to the opposite pole piece. The magnetic force is so strong that it provides all of the power required to move the armature under its design load and then to hold the armature firmly to the pole piece, thus latching the solenoid in its new state.

Any further change of state is effected similarly.

The device may be manufactured to any resonable scale to suit its particular appliction.

CLAIMS

1. A Bistable Latching Solenoid. Comprising a steel (or other magnetically conductive material,) frame together with, two specifically shaped pole receptors, one of which provides a bearing bore, Located between the two pole receptors is a cylindrical armature, the armature is located within a plastic guide which includes a former for two coil windings. The armature has means to exert a constant and predetermined pressure via an integral spring.
There are two magnets (sintered neodymium iron boron) located within the frame to provide the magnetic forces.

2. A Bistable Latching Solenoid as claimed in Claim 1. where the device obtains the majority of its motive force from permanent magnets ,sintered neodymium iron boron type in conjunction with a magnetic force derived from an opposing coil.

3. A Bistable Latching Solenoid as Claimed in claim 1 or Claim 2 wherein the specially shaped pole receptors provide a significant increase in magnetic attraction allowing the solenoid to remain securely latched in or out.

4. A Bistable Latching Solenoid as claimed in Claim 1 ,Claim 2 or Claim 3 whereby the device requires only a pulse at its rated voltage (typically 5 milliseconds) to change state from in to out.

5. A Bistable Latching Solenoid as Claimed in any preceding claim, whereby the latching force may be greater, equal to or less than the force required to unlatch .

6. A Bistable Latching Solenoid as claimed in any of the preceding claims, whereby the solenoid may be easily modified by changing magnet size to provide a range of latching forces, from fraction of a kilogram to hundreds of kilogram.

7. A Bistable Latching Solenoid as Claimed in any of the preceding claims, whereby the armature is internally spring loaded to give precise control over 'Hold On' force

8. A BISTABLE LATCHING SOLENOID AS CLAIMED IN ANY OF THE PRECEDING CLAIMS AND DESCRIBED HEREIN WITH REFERENCE TO FIGURES 1 TO 4 OF THE ACCOMPANYING DRAWINGS.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

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Application number
GB 9311202.7

Relevant Technical Fields

(i) UK Cl (Ed.M) H1P (PBA, PMR)

(ii) Int Cl (Ed.5) H01F

Search Examiner
C D STONE

Date of completion of Search
17 AUGUST 1994

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-
ALL

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 1591471	(HART)	1
X	WO 81/01626 A1	(GOTTSCHALL)	1
X	US 4829947	(GENERAL MOTORS)	1
X	US 3895331	(RICHDEL)	1
X	US 3728654	(HOSHIDENKI-SEIZO)	1
X	US 3634735	(KOMATSU)	1
X	US 3202886	(BULOVA)	1

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